REMARKS

Claims 1 - 4 and 18 – 20 are pending in the present application. The rejection of claims 1 – 4 and 18 – 20 under 35 U.S.C. §103(a) was maintained in the Final Office Action. Claims 1 and 18 have been amended herein to clarify that the sequential vapor deposition process occurs in a single reaction chamber. This amendment is supported by, for example, pages 10 – 12 of the specification and Figure 1. Claims 1, 2, 18 and 19 have also been amended to ensure proper antecedent basis. No new matter is added by the amendments.

Claim Rejections Under 35 U.S.C. §103

The Examiner maintained the rejection of Claims 1 – 4 and 18 – 20 under 35 U.S.C. §103(a) as being unpatentable over the combination of Matsumoto (5,480,818) and Penneck (4,985,313). Applicant respectfully submits that the combination of Matsumoto and Penneck does not teach or suggest *inter alia* deposition of Al_2O_3 on a substrate by a cyclical sequential vapor deposition process in which the substrate is exposed to trimethyl aluminum (TMA) and atomic oxygen in a single reaction chamber.

The process disclosed in Matsumoto for the deposition of aluminum oxide does not teach or suggest using atomic oxygen as the oxygen source, as recited in independent Claims 1 and 18. Instead, every embodiment mentioned in Matsumoto relies on water vapor to grow Al_2O_3 film. No Al_2O_3 growth occurs in the separate plasma chamber used in Matsumoto to deposit a silicon film over the Al_2O_3 film (column 16, lines 12-17). The use of water vapor to grow the Al_2O_3 film does not in any way teach or suggest using atomic oxygen in the aluminum oxide deposition process.

The Examiner found that while Matsumoto does not teach use of atomic oxygen as the oxygen source, this deficiency was made up for by Penneck, which teaches moving a substrate, on which a metal layer has previously been deposited, through oxygen plasma to form a coating of metal oxide. Claims 1 and 18 have been amended to clarify that the sequential chemical vapor deposition processes, including exposure of the substrate to TMA and atomic oxygen, takes place within a *single reaction chamber*. Penneck does not teach or suggest this feature.

The process disclosed in Penneck and cited by the Examiner (column 11, lines 1 – 18) is directed to the oxidation of a complete, previously deposited aluminum layer. That is, the

aluminum layer is deposited to a desired thickness and then subsequently oxidized in a plasma oxidation unit. There is no suggestion that the plasma should be supplied in the same reaction chamber in which the aluminum is deposited.

In addition, the process disclosed in Matsumoto comprise a plurality of cycles in which Al_2O_3 is deposited. That is, thin layers of Al_2O_3 are deposited in multiple cycles. In the process in Penneck, all of the aluminum is deposited first, after which the layer is oxidized. Further, Penneck is directed to forming aluminum oxide on cables, and thus would not have the same concerns as Matsumoto, which is directed to thin films used in integrated circuits. Because of the significant difference in the processes and results described in the references, one of skill in the art would not combine the teachings of Penneck with Matsumoto in a manner that meets the claims. There is simply no teaching or suggestion in the references nor the art generally to use atomic oxygen in a cyclical process to deposit aluminum oxide on a substrate in a single reaction chamber.

Further, Claim 1 explicitly indicates that in each cycle, "more than one monolayer of Al_2O_3 is formed." In contrast, Matsumoto teaches a true atomic layer deposition process in which less than one monolayer is deposited per cycle. Matsumoto states that "...an aluminum (Al) layer and an oxygen (O) layer are deposited alternately, thereby to grow an Al_2O_3 film having a thickness of 400 nm composed of a plurality of *monoatomic layers*" (column 5, lines 59 – 63; emphasis added).

The Examiner found Matsumoto at Col. 7, lines 29-49 to teach forming more than one monolayer. However, the claim recites more than one monolayer *per cycle*. Col. 7, lines 29-49 of Matsumoto teaches forming 50 nm after 300 cycles – or a deposition rate of 1.67 angstroms/cycle, which is *less* than one monolayer per cycle. Thus, the process described in Matsumoto deposits at most one monolayer *per cycle*. There is no teaching or suggestion in Matsumoto (or Penneck) to deposit more than one monolayer of Al_2O_3 per cycle.

Finally, with respect to Claims 4 and 20, Matsumoto teaches away from methods of depositing an Al_2O_3 film at room temperature. Matsumoto teaches a thermal ALD process and thus includes a substrate heater in every embodiment (column 5, lines 11 – 12). Matsumoto describes heating the substrate to anywhere between 250 degrees Celsius and 450 degrees Celsius (column 5, line 33; column 7, line 22; column 9, line 11; column 10, line 14). The high

temperatures mentioned in Matsumoto (in comparison to room temperature) indicate a difference in the processes that cannot be explained away by routine experimentation and would not be obvious to one of ordinary skill in the art. Room temperature would not be expected to work in the process of Matsumoto and simply would not have been tried. Thus Matsumoto does not teach or suggest a process of depositing an aluminum oxide film at room temperature.

The remaining dependent claims also teach further distinguishing features of particular utility, but are not separately addressed as moot in view of the patentability of Claims 1 and 18, as discussed above.

In view of the remarks and amendments presented herein, Applicants respectfully submit that the pending claims are not obvious in view of the combination of Matsumoto and Penneck and request withdrawal of the rejections under 35 U.S.C. §103(a) and allowance of the pending claims.

Respectfully submitted,

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